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April 30, 2002

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Subject: **Draft Wabuska Drain Work Plan**
Yerington Mine Site, Lyon County, Nevada

Dear Art:

Atlantic Richfield Company has prepared the attached Draft Wabuska Drain Work Plan for the Yerington Mine Site for your review. If you have any questions regarding Work Plan, please call me at 1-406-563-5211 ext. 430.

Sincerely,

Dave McCarthy
Project Manager

cc: Bonnie Arthur, SFD-8-1, USEPA Region 9
Brad Shipley (BLM)
Tad Williams, Walker River Paiute Tribe
Robin Bullock, Atlantic Richfield Company
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Stan Wiemeyer, U.S. Department of the Interior, Fish and Wildlife Services Division
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Draft

WABUSKA DRAIN WORK PLAN

APRIL 30, 2002

PREPARED FOR:

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SECTION 1.0
INTRODUCTION

Atlantic Richfield Company has prepared this Draft Wabuska Drain Work Plan (Work Plan) to conduct field investigations that will support an evaluation of the potential risk to human health and the environment that may result from mine-impacted groundwater that may enter the Wabuska Drain immediately north of the Yerington Mine site. This Work Plan is being conducted under the authority of an Administrative Order issued by the Nevada Division of Environmental Protection – Bureau of Corrective Actions (NDEP) as part of site closure investigations described in the Closure Scope of Work (SOW). As stated in the SOW (Brown and Caldwell, 2002), a "hydrologic and geochemical assessment of the Drain will be performed at up to four monitoring locations, including flow measurements and the collection of surface water samples and soil samples for laboratory analysis".

The remainder of Section 1.0 of this Work Plan describes the location and hydrologic setting of the Wabuska Drain (Drain), previous sampling and analytical results obtained from AHA (1983) and NDEP 1999, and describes the Work Plan objectives in more detail. Section 2.0 presents information about the construction and operational history of the Drain and a description of alignment modifications over time, based on an interpretation of aerial photography and topographic maps. Section 3.0 presents data quality objectives, proposed sampling locations, how measurements of surface flows will be made, and sampling protocols for water quality and soils/sediment analyses. In addition, Section 3.0 of this Work Plan presents a task-specific Job Safety Analysis in the context of a more comprehensive Health and Safety Plan. Section 4.0 lists references cited in this Work Plan.

1.1 Location

The Wabuska Drain is an agricultural return-flow drain located in northern Mason Valley, Lyon County, Nevada (Figure 1). The Drain originates immediately north of the Yerington Mine site and is aligned to the north past its intersection with the West Campbell Irrigation Ditch, and through the Paiute Indian Reservation. Further to the north, it crosses Highway 95A approximately one mile south of the town of

Wabuska, where it is aligned to the east-northeast to its intersection with the Walker River north of the Mason Valley Wildlife Management Area (Figure 1). The Drain is approximately 13.8 miles (72,580 feet) in length.

1.2 Hydrologic Setting

The principal source of water in the Yerington area of Mason Valley is from the Walker River (Huxel, 1969). The East and West Walker Rivers originate in the Sierra Nevada and merge south of the mine site, from where the Walker River flows northward through the valley to Walker Gap. From Walker Gap, it turns eastward and then southeastward to Weber Reservoir and ultimately to its terminus, Walker Lake. The Walker River is the primary source of natural recharge to the alluvial groundwater flow system that underlies the mine site, given that recharge from precipitation is very low (the annual average precipitation rate in the area is 5.46 inches per year; Huxel, 1969). The Walker River Irrigation District (WRID) was organized in 1919 to allocate and manage agricultural diversions along the river.

Streamflow data on the Walker River in the Mason Valley area have been collected intermittently since 1895, and continuously since 1947 (Huxel, 1969). In general, the greatest volume of runoff in the Walker River basin occurs during the period from March to July, when the winter snowpack in the Sierra Nevada thaws. Exceptions to this pattern occurred during winter flood events that occurred in 1937, 1950, 1955, 1963 and 1997 as a result of warm rain on the mountain snowpack. These winter floods are usually of high intensity and short duration, and do not typically produce the total volume of surface flows from spring snowmelt (Huxel, 1969). The large volume of spring runoff provides irrigation water and storage upstream of Mason Valley for use later in the irrigation season.

The Drain is one of the agricultural return-flow features that comprise a complex network of diversions (e.g., the Campbell Ditch) and irrigation drains used to manage Walker River water for agricultural activities in Mason Valley. Huxel (1969) recognized that return flows to the river in the upper reaches of Mason Valley were re-diverted into downstream canals and ditches. In the Yerington sub-area, Huxel (1969) estimated that approximately 9,700 acres of cropland and pasture were irrigated by an average of 12,200 acre-feet.

The Drain operates by collecting runoff from crop irrigation and precipitation, and by intercepting rising groundwater in the shallow alluvium that rises to an elevation that intercepts its base. Rising groundwater levels result from natural recharge (seepage from the Walker River or direct precipitation) and/or cultural recharge (seepage from agricultural diversions such as the Campbell Ditch and recharge from irrigated fields). In addition to direct runoff from irrigated fields, runoff from direct precipitation on roads, streets and highways also contribute to flows in the Drain.

The alluvial aquifer that contributes groundwater inflows into the Drain consists of unconsolidated alluvial deposits derived by erosion of the uplifted mountain block of the Singatse Range and alluvial materials deposited by the Walker River. These unconsolidated deposits, collectively called the valley-fill deposits by Huxel (1969), comprise four geologic units: younger alluvium (including the lacustrine deposits of Lake Lahontan), younger fan deposits, older alluvium and older fan deposits. Lake Lahontan lacustrine deposits appear to have been removed and reworked by the Walker River as it meandered back and forth across the valley Huxel (1969). Huxel estimated that Pleistocene Lake Lahontan in Mason Valley persisted for a relatively short time and was less than 60 feet deep.

The hydraulic grade of the Wabuska Drain between the Yerington Mine site and the southern margin of the Paiute Indian Reservation (Figure 1) is approximately 0.148 percent over 4.1 miles. The grade increases slightly to about 0.160 percent within its 1.1 mile-length within the reservation. From the northern margin of the reservation to its intersection with the Walker River, the average hydraulic grade was calculated at 0.042 percent.

The Wabuska Drain was designed as a low-gradient (low energy) V-shaped to trapezoidal conveyance. Its channel dimensions become larger in the downgradient direction as the drainage area increases. According to the Walker River Irrigation District (Ken Spooner, WRID; pers. comm., 2002), the Drain requires minimal maintenance, typically involving the clearing of brush (by burning) and routine culvert maintenance.

Brown and Caldwell inspected the Drain on March 5, 2002 and did not find evidence of significant erosion or sediment accumulation along the Drain's extent. Portions of the Wabuska Drain have established vegetation, which increases the channel roughness and reduces sediment transport. Some areas along the Drain have been burned to clear vegetation. The dimensions and slope of the Drain were estimated from field observations and available topographic information.

Given the flow characteristics calculated for the low-gradient Wabuska Drain, local movement of suspended solids (less than one millimeter size fraction) may occur, although normal sediment transport will be retarded by channel roughness during typical flow conditions. Therefore, sediment transport resulting from agricultural return flows and passive inflows of groundwater will, in general, be limited. However, greater than average channel flow caused by rainfall and runoff conditions may be expected to transport relatively fine particles in suspension for some distance. The collection of field data, including flow rates and water quality, would provide important pathway information in evaluating these hydrologic conditions.

1.3 Previous Monitoring

Applied Hydrology Associates (AHA, 1983) collected surface water samples from the Wabuska Drain in March 1983 for water quality analyses, and measured surface water flow rates at five locations. This field investigation was conducted prior to the construction of the pumpback well system in 1985 that was designed to intercept groundwater in the shallow alluvial aquifer that may have been affected by past mining operations and surface mine units. Continued operation of, and improvements to, the pumpback and evaporation system have been effective in improving shallow groundwater quality north of the mine site (AHA, 2002).

AHA measured surface water flows at four locations along the Drain in the area immediately north of the mine (Figure 2), and at one location where it crosses Campbell Road. Flows from the four Drain locations between the mine site and Luzier Lane were measured using a portable cut-throat flume that was placed on the Drain bed parallel to the channel axis. Dirt was placed on either side of the flume in order to direct all channel flow through the flume, and care was taken to ensure that the flume was properly leveled in the channel. Water levels in the flume were recorded and a rating table was used to convert the measurements to discharge in cubic feet per second (cfs).

Recorded flow rates ranged from 0.01 to 0.06 (4.5 to 27 gpm) at the four locations immediately north of the mine, which progressively increased down-gradient, and 4.9 cfs (2,200 gpm) at the Campbell Road location (AHA, 1983; Appendix II). The portable flume could not be used to measure flows in the Wabuska Drain at Campbell Road because the discharge was too large. Therefore, AHA (1983) estimated discharge at this location by calculating the cross-sectional area and slope of flow through the culvert under Campbell Road and using Manning's equation (a slope of one percent and a coefficient of "n" of 0.024 were used in this calculation).

AHA collected grab samples from the Drain near the mine site because the shallow depth of flow prevented the use of a pump to obtain surface samples for water quality analyses. However, the shallow depth of water allowed for a sample to be collected that represented the total depth of flow. AHA took care to not disturb the bottom sediments when the water was sampled. Grab samples were also taken from the Wabuska Drain at Campbell Road in order to maintain consistency of sampling techniques. The sample was collected at a depth of approximately five inches from the water surface. Field measurements of pH, specific conductance and temperature were obtained for all sample locations during surface water sampling. Sample preservation, filtering, storage and transportation of the surface water samples were described in AHA (1983).

The results of water quality analyses of samples taken from the five Drain locations are shown in Table 1-1, reproduced from AHA (1983). In general, there was little difference between the concentrations of dissolved, total and total recoverable analyses of the analytes at each of the four sampling locations located immediately north of the mine site. Most constituents showed increases in concentration from Locations 1 to 4, corresponding to the direction of flow. Measured flows at these locations indicated that increased groundwater inflows into the Drain occur along this reach, from Locations 1 to 4, as described above.

AHA recognized that the sulfate concentration was highest at Location 3 in the area where shallow groundwater contamination has been identified. The lowest pH level was noted at Location 2, which suggested that discharge of acidic groundwater likely occurred somewhere between Locations 1 and 2 (AHA, 1983). The concentration of iron increased dramatically at Location 2, also suggesting inflows of impacted groundwater between Locations 1 and 2. Analytical results (Table 1-1) for surface water sampled from the Wabuska Drain at Campbell Road (Location 5) indicated good quality water (AHA, 1983).

NDEP conducted water quality sampling at four locations along the Wabuska Drain on November 15-16, 1999. The sample location map, water sampling records and summary of analytical results are presented in Appendix A. NDEP sample locations are also shown in Figure 2. The southernmost sample, WSW-011, was collected from stagnant water north of the mine site, about 0.1 miles north of Luzier Lane (north side of culvert). The next sample (from south to north) at location WSW-008, was collected from flowing water in the Drain about 1.2 miles north of WSW-011 (about 0.3 miles south of the Drain's intersection with the West Campbell irrigation ditch). The third sample, WSW-009, was collected from flowing water in the Drain at its intersection with Campbell Lane (north side of culvert). The fourth and northernmost sample, WSW-010, was collected from flowing water in the Drain immediately west of its intersection with Highway 95A.

Analytical results from the Wabuska Drain samples collected by NDEP are presented in Table 1-2 and in Appendix A. These data indicate that the sample collected immediately north of the mine site, WSW-011, contained elevated concentrations of several constituents relative to the down-gradient samples (arsenic, barium, boron, calcium, iron, magnesium, manganese, potassium, selenium, sodium, vanadium and zinc). However, because this sample was collected from stagnant water at this location, these constituents were not transported down-gradient (i.e., non-flowing conditions resulted in no loading of these constituents). The chemical quality of this stagnant water sample may have been affected by evapoconcentration, reducing conditions associated with a natural wetland environment and/or direct runoff from the adjacent agricultural field.

1.4 Data Quality Objectives

The Data Quality Objectives (DQOs) for field sampling and analytical activities described in this Work Plan include the collection of appropriate data to support the:

- Assessment of ecological and human health risk resulting from surface water and sediment in the Wabuska Drain being conveyed to possible down-gradient receptors, and identification of such receptors;
- Assessment of ecological and human health risk resulting from the possible development of metal-bearing soils in or adjacent to the Wabuska Drain (including identified abandoned portions); and
- Development and evaluation of closure alternatives for mine closure units at the Yerington Mine site.

In order to ensure that data of sufficient quality and quantity are collected to meet the project objectives, the four-step DQO process listed below was utilized to develop the activities described in this Work Plan:

- Step 1. State the Problem;
- Step 2. Identify the Decision;
- Step 3. Identify the Inputs to the Decision; and
- Step 4. Define the Boundaries of the Study.

The problem statement (Step 1) is as follows: "Shallow groundwater in the area north of the Yerington Mine site has been affected by past mining operations and mine closure units present at the site. The Wabuska Drain (an agricultural return flow conveyance feature constructed prior to mining operations) may intercept this shallow groundwater and transport constituents of concern via surface water flows and sediment transport to down-gradient receptors. Surface water flows and transported sediment or soils may pose a risk to human health and the environment. In addition, sediment and soils that may have accumulated within or adjacent to the current alignment of the Drain, or in abandoned portions of the Drain, could also pose a risk to human health and the environment."

Step 2 of the DQO process (Identify the Decision) asks the key question that this Work Plan is attempting to address: "What monitoring, sampling and analytical activities for locations along the Wabuska Drain will serve to evaluate the potential for ecological and human health risk, and support closure of the Yerington Mine site?" The field monitoring and sample collection and analysis activities proposed in this Work Plan will be compared to previous investigations (AHA, 1983 and NDEP, 1999) and will provide the basis for potential future investigations to answer this question. The criteria necessary to determine if the proposed Work Plan activities will answer this question include:

- Will the collected data adequately document the fate and transport of constituents of concern in Wabuska Drain surface water flows, and in transported soils or sediments, to down-gradient receptors;
- Will the collected data provide an evaluation of environmental pathway processes that occur in the Wabuska Drain; and
- Will the collected data provide an appropriate baseline to assess the effects of site closure on the Wabuska Drain pathway (e.g., water quality improvements).

Step 3 of the DQO process (Identify the Inputs to the Decision) identifies the kind of information that is needed to address the question posed under Step 2. Relevant historical and anecdotal information includes knowledge of Drain construction, operations and maintenance, past Drain alignments, previous field monitoring and analytical results, and down-gradient receptors. The information to be obtained from the proposed field monitoring and sample collection and analytical activities will provide an adequate basis to begin to satisfy these criteria.

Step 4 of the DQO process (Define the Boundaries of the Study) defines the spatial and temporal aspects of the field monitoring, sampling and analytical activities proposed in this Work Plan. The sample locations used by NDEP (1999) have been retained for the four sample locations given their spatial distribution and the occurrence of good quality surface water at the northernmost site (WSW-010). The quality of surface water monitored at WSW-010, compared to up-gradient monitoring locations, indicates that physical and chemical processes occurring within the Wabuska Drain result in improved water quality with distance from the mine site. The field and analytical activities described in this Work Plan will be conducted in June 2002.

SECTION 2.0
HISTORICAL ALIGNMENT

As described above, the Wabuska Drain was designed and constructed as a low-gradient trapezoidal conveyance with dimensions that become larger in the down-gradient direction as the drainage area increases and subsidiary drains join the Drain along its length. It was constructed to collect and convey excess water associated with irrigation activities and seasonal groundwater level fluctuations. Operations and maintenance of the Drain are controlled by the WRID, although the Drain crosses private lands (permission to access proposed sample locations may be required by private land owners). According to the WRID, the Drain requires minimal maintenance, which typically includes the clearing of brush and routine culvert maintenance (Ken Spooner, WRID; pers. comm. 2002). During development of this Work Plan, Brown and Caldwell did not find evidence of sediment accumulation along the Drain's alignment, including proposed sample locations.

The alignment of the Wabuska Drain has shifted slightly over time in the area immediately north of the Yerington Mine, as seen in the aerial photos and topographic maps from 1938 to the present time (Appendix B). These maps and photos are produced at two scales, 1:30,000 and 1:12,000, to show details in the area north of the mine and to shows its alignment to the north including and beyond the Paiute Indian Reservation. Insets for specific maps and aerial photos are provided at 1:12,000 for direct comparison with other aerial photographs.

Also included is a 1915 topographic map to illustrate that a portion of the Drain appears to have been built on, or in close proximity to, the former Nevada Copper Belt Railway. This is also shown on the 1957 topographic map.

As depicted in the maps and photos presented in Appendix B and described below, all mapped changes in Drain alignment and extent have occurred in the area immediately north of the mine site. No apparent modifications to the Drain have occurred north of the irrigated fields approximately 4,200 feet north of Luzier Lane.

1938 Aerial Photo (B1)

This photo mosaic is the earliest evidence of the approximate position of the Wabuska Drain, which appears as a dark line with white lines running parallel on both sides. The dark line is the drain, while the white lines are channel banks or possibly access roads. The beginning of the Drain is located approximately where the lower label line touches the Drain, and can be delineated from a road or railroad alignment located to the west. This road, or railroad, which appears in the photo from the south and runs through the middle of the illustration, follows the former Nevada Copper Belt Rail Line.

1954 Aerial Photo (B2)

The Drain is discernable in the photo as a dark line with a white line next to it, and is slightly offset from the road or railroad alignment located to the west (identified in the 1938 aerial photo). There appears to be no change in alignment of the Drain from 1938 to 1954 in the area covered by the two aerial photo groups. However, the 1954 aerial photos do not provide as much coverage as the 1938 series. Note the road that outlines the tailings disposal area and other mine site features for reference.

1957 USGS Wabuska, NV Topographic Map (B3)

This topographic map is the first available evidence of the Drain alignment some miles to the north of the Yerington Mine site. The Drain begins approximately 1,800 feet north of the "Tailings Pond." From there, it continues north and crosses the Campbell Ditch approximately two miles north of the mine. The position of the Old Railroad Grade on this map is similar to that shown on the previous aerial photos (B1 and B2). The East and West arms of the Campbell Ditch are identified on the map along with other unnamed conveyance features. There appears to be no change from the 1938 and 1954 Drain alignment to the 1957 alignment for the area covered by both the photos and the map.

1977 Aerial Photo (B4)

The 1977 aerial photo mosaic provides a color illustration of the mine prior to close of operations the following year. The Wabuska Drain is defined by its dark color bounded by white roadways on either side. The southern terminus of the Drain remains in the same general position to the northeast of the northern-most evaporation pond (labeled in B3 as the "Tailings Pond"). A number of conveyance features located north of the mine are dark-colored and are characterized by vegetation-lined banks. Ditches located immediately north of the sulfide tailings pond appear to have been constructed to contain tailings fluids up-gradient of the irrigated fields, which appear to have separate conveyance features (labeled as Conveyance Features in the photographs presented as B-4 and B-5).

1980 Infrared Aerial Photo (B5)

The 1980 infrared aerial photo mosaic illustrates the Drain as a dark red/amber color indicative of vegetation within and adjacent to the Drain. The Drain alignment and other conveyance features north of the mine do not appear to have changed from 1977.

1987 USGS Mason Butte, NV Topographic Map (B6)

The 1987 map is the first evidence of a change in Drain alignment, and depicts the Drain beginning southeast of its former location, in the area of the "other conveyance features" shown in B4 and B5. The Drain begins north of the sulfide tailings labeled on the map as "Tailings Pond" and parallels its northern margin to a northwest alignment parallel to a road. The Drain alignment changes as it approaches Luzier Lane, where the Drain jogs back to the east and then heads north for approximately 3,000 feet before heading west and back to the northeast to its original alignment. B8 illustrates these alignment changes.

2001 Color Air Photo (B7)

In this aerial photo, the Drain begins in a similar position shown in B6, north of the sulfide tailings. It parallels the tailings for less than a half-mile before turning northwest and then due north. This portion of the alignment differs from that shown in B6, without the east-north-west jog that is apparent in B6. The remainder of the Drain alignment appears to correspond to historical alignments. Note that most of the other conveyance features that appeared in previous aerial photos no longer exist.

Historical Wabuska Drain and Other Conveyance Alignments (B8)

The alignment of the Drain and other conveyance features were digitized from the aerial photos and topographic maps and combined on the 2001 aerial photo base to illustrate the alignment changes over time. The two major changes in the Wabuska Drain alignment occurred in the time periods between 1980 and 1987 and 1987 and 2001.

SECTION 3.0
WORK PLAN

Atlantic Richfield proposes to conduct field monitoring and sample collection activities at four locations along the Wabuska Drain in accordance with the agency-approved SOW. Field activities will be conducted in a manner consisted with the "Field Sample Plan" prepared by NDEP (1999a) for similar activities conducted in November 1999. The Drain has been identified as the only surface water pathway from the mine site (NDEP, 1999a): "The only surface water of concern is an irrigation drainage ditch known as the Wabuska Drain, a re-turn-flow irrigation ditch. In the past, ditch sediments in the area north of the site had become discolored, the suspected source of contamination being from the site. The ditch is used to capture groundwater flood irrigation runoff from adjacent fields". In addition, Atlantic Richfield will collect solid media from the proposed surface water monitoring locations and from the abandoned portion of the Drain adjacent to the Evaporation Ponds.

3.1 Monitoring Locations

Four proposed monitoring locations for the collection of flow measurements, water quality samples from surface flows, and soil/sediment samples within the Drain are shown in Figure 2. These locations generally coincide with NDEP sample locations WSW-008, WSW-009, WSW-010 and WSW-011 from the 1999 field investigation presented in Appendix A. These locations will allow data collected as part of this Work Plan to be evaluated in the context of the 1999 data collected by NDEP. Also shown on Figure 2 are two sampling locations of soils in the abandoned portion of the Drain adjacent to the Evaporation Ponds. All monitoring locations will be field-located using a combination of global positioning system (GPS) measurements and mapping using known cultural and topographic features.

3.2 Quality Assurance and Quality Control

Procedures for data collection and analysis will follow the specifications and standard operating procedures (SOPs) described in this section. These procedures will ensure that the type, quantity, and quality of data collected are reliable with regard to providing information needed to satisfy the DQOs listed in Section 1.4. Data collected from field and laboratory activities will be used to:

- Evaluate the chemical and physical characteristics of water flowing in the Wabuska Drain;
- Determine chemical and physical changes in water flowing in the Drain, relative to locations along its length; and
- Provide information essential for assessing the presence of, and concentrations of, constituents of concern in soil and water

The data collection and analysis procedures will adhere to quality assurance/quality control (QA/QC) methods to ensure that the quality and quantity of the analytical data obtained during the field activities are sufficient to support the DQOs. QA/QC issues include:

- Detection limit and laboratory analytical level requirements;
- Selection of appropriate levels of precision, accuracy, representiveness, completeness, and comparability for the data and any specific sample handling issues; and
- Identification of confidence levels for the collected data.

The following describes field measurements and laboratory analytical measurements that will be conducted as part of this Work Plan.

3.3 Data Collection and Analysis Procedures

Field Measurements

Measurements in the field will consist of flow rates of surface water in the Drain, physical channel dimensions and distances, and physical parameters for water and solid media. Field information shall be recorded in a field notebook. For each sampling event, the information described in the Documentation section provided below will be recorded.

Prior to sampling, the pH, dissolved oxygen and electrical conductivity probe(s) shall be calibrated and the conductivity probe shall be checked with a standard. After sampling is completed, a drift check shall be performed with each instrument, using the same standard solutions used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different locations.

Field parameters shall be measured after each sample collected, to avoid possible cross-contamination at the sample location. Measurements of surface water shall be collected from two to three inches below the water surface. Care will be taken to prevent disturbance of the Drain sediment or soil along the bank that could roll down into the water. Temperature and conductivity surface water measurements shall be collected by placing the test cup and probe directly under the water surface. Measurements of surface water pH, dissolved oxygen and electrical conductivity shall be collected by placing the probe directly under the water surface, allowing the pH value to stabilize, and recording the value. Measurements of solid media pH shall be collected by performing paste pH tests at depths of 0.5, 1.0, and 2.0 feet below ground surface.

The physical measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments. Instrument accuracy limits will be specified in the results section of the Data Summary Report.

Surface Water Sample Collection

Water sampling of the Drain shall be started at the most "downstream" location and progressed in an "upstream" direction. Samples at each location shall be collected prior to recording field parameters or measuring flow. High-density polyethylene (HDPE) bottles, supplied the analytical laboratory, shall be used to collect samples. Prior to collecting the actual lab sample, the collection bottle will be marked with a collection sequence number, and triple-rinsed with the water source being sampled. The water samples shall be collected slightly "upstream" of where the bottles are rinsed, to prevent disturbed sediment from contaminating the sample. Water samples shall be collected from just below the water surface, taking care to avoid sampling where surface debris is present. Care will also be taken to prevent disturbance of the bed sediment or soil along the bank that could roll down into the Drain. Latex gloves shall be used to handle bottles and equipment throughout each sampling event. The gloves shall be changed between each sample location.

Both total metals (unfiltered) and, dissolved metals (filtered) samples shall be each collected in 500-milliliter (mL) bottles. Non-metals samples shall be collected in 1,000-mL bottles, unfiltered, with no acid preservation. Sample bottles for the blank shall not be triple-rinsed prior to being filled, so that any contamination from bottles alone would be detected.

The following is a brief summary checklist for water sampling, based on the sampling protocol outlined above:

1. Locate accessible portions of the Drain where access and sampling activities create minimal disturbance to the water that will be sampled. Flowing water is required for sampling. Therefore, proposed sample locations with stagnant water will not be sampled, and the most immediate down-gradient location where flowing water in the Drain is observed will be sampled. Sample from downstream locations to upstream locations.
2. Wear a new pair of latex gloves prior to each sampling location. Place indelible identifying mark or label on the container. Fill container directly by carefully submerging a portion of the mouth of the container into the flow, with the body of the container and hand downstream of bottle mouth. Adjust the container position as needed to obtain a nearly full container (a small head-space may remain).
3. Thoroughly rinse container, dumping out downstream of where sample will be collected. Repeat two more times.
4. Unfiltered Samples: Collect the sample in same manner, rinse the cap in flow, seal the container, and wipe off the outside with a clean paper towel.
5. Filtered Samples: Collect the sample in the same manner, and perform steps #2 and #3 for an additional empty bottle to filter into. Using an in-line pump with a new 0.45 micron filter and new line, carefully filter the water from the full bottle into the empty one. Perform this activity away from the Drain, taking care not to allow unfiltered water present on surface exteriors to enter the filtered water bottle. Use a fresh pair of gloves for the filtering procedure. Replace the cap, seal the container, and wipe off the outside with a clean paper towel.
6. Collect the sample in same manner, rinse the cap in flow, seal the container, and wipe off the outside with a clean paper towel.
7. Measure and record flow, pH, conductivity, and temperature
8. Preserve all samples as appropriate, compete documentation, package and ship or transport samples.

Decontamination

For surface water sampling, all equipment shall be disposable or one-time use, with the exception of the in-line pump. Although the pump should not normally come in contact with water, decontamination of the pump between sample locations shall occur in the same manner as soil sampling equipment decontamination described below, using decontamination water dedicated for the pump.

For solid media sampling, all equipment shall be decontaminated between each sampling location. Clean buckets or tubs (5 gallon buckets are most common) should be used. Buckets should be placed on plastic sheeting to prevent spillage to the ground, and to help keep the decontamination area and equipment as clean as possible. The buckets should be filled half to three-quarters full as follows:

Bucket 1: Tap water with non-phosphate detergent such as Liqui-Nox
Bucket 2: Clean tap water or de-ionized water.
Bucket 3: Clean tap water or de-ionized water.

After the decontamination area is set up, equipment decontamination of soil sampling equipment is comprised of four general steps:

1. Removal of gross (visible) contamination

   Gross contamination generally applies to soil sampling equipment, which may have significant residue dinging to the piece of equipment. This can be removed by drybrushing or scraping or water rinse.

2 Removal of residual contamination

   All sampling equipment used at the site must be cleaned prior to any sampling effort, after each sample is collected, and after the sampling effort is accomplished. Removal of residual contamination consists of the following steps:

   a. Place the item in the first bucket (detergent wash) and scrub the entire surface area of each piece of equipment to be decontaminated. Utilize scrub brushes to remove all visible contamination. Change the water periodically to minimize the amount of residue carried over into the second rinse.

   b. Place the item in the second bucket (clear water rinse – tap or deionized water) and rinse. Change the water periodically to minimize the amount of residue carried over into the third rinse.

   c. Place the item in the third bucket (deionized or distilled water) and repeat the rinsing procedure. Change water as necessary.

d. Unless the Work Plan or FSP directs additional rinses, place the item on a clean surface such as plastic sheeting to await reuse or packaging for storage (e.g., wrapping foil).

3) Prevention of recontamination

After the decontamination process, equipment should be stored to preserve its clean state to the extent practical. The method will vary by the nature of the equipment. Protection measures include covering or wrapping in plastic or sealable plastic bags, or wrapping with oil-free aluminum foil.

4) Disposal of wastes associated with the decontamination

All washing and rinsing solutions are considered investigation derived waste and should be containerized. After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

Sample Identification and Preservation

Sample labels shall be completed and attached to each laboratory sample container after each sample is collected, to avoid saturation of the labels during water collection. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection. The labels shall be filled out with a permanent marker and shall include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consisted of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, the sample collected during the third sampling event at the fourth location sampled will be labeled: 003WD004. Blanks and duplicate samples shall be labeled in the same fashion, with no indication of their contents. For example, the duplicate sample to the one stated above might be labeled: 003WD006.

The following sample preservation methods will be followed for collected water samples:

Total Metals: Add nitric acid to a pH less than 2 after sample collection. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

Dissolved Metals: If filtered samples are required, filter sample through a 0.45 micron filter using an inline filter immediately after sample collection. Following filtration, add nitric acid to a pH less than 2 after sample collection. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

Sample Handling and Transport

The QA objectives for the sample-handling portion of the field activities are to verify that decontamination, packaging and shipping are not introducing variables into the sampling chain which could render the validity of the samples questionable. In order to fulfill these QA objectives, blank and duplicate QC samples will be used as described below. If the analysis of any QC samples indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QC sample will be evaluated for the possibility of contamination.

The following sample packaging and shipment procedures will be followed for the surface water samples to ensure that samples are intact when they arrive at the designated laboratory:

1. Place a custody seal over each container, and place each container in double zip-loc plastic bags and seal the plastic bags shut.

2. Place the protected containers in the appropriate ice chest.
3. If required, fill empty spaces in the ice chest with either pelaspan (styrofoam popcorn) or bubble-pack wrap to minimize movement of the samples during shipment. Contained ice shall be double bagged in the same manner as samples.
4. Enclose the chain of custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid.
5. Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. Place clear tape over each custody seal on the outside of the ice chest.
6. Label ice chest with "Fragile" and "This End Up" labels. Include a label on each cooler with the laboratory address and the return address.
7. Transport ice chests to the appropriate laboratory within 24 hours by hand-delivery or via express overnight delivery.

Duplicate samples will be collected at a frequency of one in ten samples for each matrix and analysis. Duplicate samples will be collected by filling the bottles for each analysis at the same time the original sample is collected. Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent "blind" to the lab. For quality assurance purpose, no special labeling indication of the duplicate shall be provided.

A field sample will be designated as the "lab QC sample" at a frequency of 1 per 20 samples (including blanks and duplicates) for all parameters. The lab QC sample is the sample the laboratory will use for its internal quality control analyses. The lab QC sample for water analyses will be a double volume sample. The lab QC sample will be a sample which is representative of other contaminated samples. The sample containers and paperwork will be clearly labeled "Lab QC Sample".

A blank sample will be collected by pouring the blank water directly into the sample bottles at one of the sample locations. De-ionized water will be used for collecting blank water samples. For quality assurance purpose, field blanks will be labeled in the same manner as other samples and will be sent "blind" to the lab, with no special indication of the nature of the sample.

Collected water samples shall be labeled, logged on a chain-of-custody form, sealed in zip-loc© bags, and placed in a cooler with ice. Cooler ice will be contained in double zip-loc© bags to avoid leakage during shipment or transport. All samples shall be kept secure in the custody of the sampler until they are transferred to the laboratory. Chain-of-custody protocol will be followed throughout the transport process. Each chain-of-custody shall contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers
- Analyses requested
- Filtration completed or required
- Method of shipment

For soil or sediment samples collected from the Drain, each sample will be collected in a two-gallon zip-loc bag that will be sealed and labeled with similar QA/QC procedures described for the water sample labeling and packaging prior to shipment to the analytical laboratory.

<u>Laboratory Analyses</u>

Laboratory analyses for surface water samples collected from the Wabuska Drain will be conducted in accordance with Table 3-1. Solid media samples shall be analyzed in accordance with Table 3-2.

Criteria that are qualitative and quantitative indictors of laboratory data quality are precision, accuracy, representiveness, completeness, and comparability, and are described below:

- Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions (usually expressed in terms of the relative percent difference or standard deviation).
- Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Usually expressed in terms of percent recovery.

- Representiveness refers to a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations that are under study.
- Completeness describes the amount of valid data obtained from a series of measurements relative to the amount that anticipated to meet Work Plan goals.
- Comparability expresses the confidence with which one data set can be compared to another. Data comparability can be ensured by reporting each data type in consistent units (e.g., all field measurements will be reported in consistent units and analytical methods will be similar or equivalent for all rounds of sampling). Comparability and representiveness are also ensured by the use of established field and laboratory procedures and their consistent application.

Water samples shall be analyzed for dissolved metals, total metals, sulfate, nitrate, chloride, acidity, alkalinity, hardness, and total dissolved solids. Solid media samples shall be analyzed for total recoverable metals. A state-certified laboratory shall perform laboratory analyses.

Documentation

Summary of field measurement and sampling activities will be recorded in a bound site logbook, and entries must contain accurate and inclusive documentation of project activities in objective and factual language. Entries will be made using permanent waterproof ink, and erasures are not permitted. Errors shall be single-lined out, should not be obscured, and initialed and dated. The person making the entries will sign at the beginning and the end of the day’s entries, and a new page will be started for each day.

The following entries will be made to the bound site logbook and/or filed log sheets:

- General descriptions of weather conditions
- Location of each sampling point
- Data and time of sample collection (field log sheets.)
- The type of blank collected and the method of collection
- Field measurements made, including the date and time of measurements
- Calibration of field instruments
- Reference to photographs taken
- Date and time of equipment decontamination
- Field observations and descriptions of problems encountered

- Duplicate sample location

Photographs will be taken at each field measurement/sampling point. The photo location and number will be recorded on the field log sheets.

Surface Water Flow Measurements

Channel flow will be measured with either an 8-inch Baski cutthroat flume or with a Pygmy current meter. The 8-inch Baski flume will be used for flow measurements in the range from 0.190 gpm to 1000 gpm when site conditions permit. If lower tolerances are required, then a 1 to 4-inch Baski flume may be used. The 1-inch flume is capable of flow measurements down to 0.0225 gpm. For all other flow conditions a Pygmy meter will be used to determine flow rate. When applicable, the flume will be used, and the current meter will only be used as an alternative method of measuring flow rate.

3.4 Site Job Safety Analysis

A site-specific Job Safety Analysis (JSA) will be prepared on the basis of the Yerington Mine Site Health and Safety Plan (SHSP). The SHSP identifies, evaluates, and prescribes control measures for safety and health hazards, in addition to providing for emergency response at the Yerington Mine site. SHSP implementation and compliance will be the responsibility of the contractor, with Atlantic Richfield taking an oversight and compliance assurance role. Any changes or updates will be the responsibility of the contractor with review by Atlantic Richfield Safety Representative Lorri Birkenbuel. Three copies of this plan will be maintained. One copy will be located at the site, one copy will be located in Atlantic Richfield's Anaconda office, and one copy will be located in the contractor's office. The SHSP includes:

- Safety and health risk or hazard analysis;
- Employee training records;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);

- Decontamination procedures;
- Emergency response; and
- Spill containment program.

The SHSP includes a section for site characterization and analysis that will identify specific site hazards and aid in determining appropriate control procedures. Required information for site characterization and analysis includes:

- Description of the response activity or job tasks to be performed;
- Duration of the planned employee activity;
- Site topography and accessibility by air and roads;
- Safety and health hazards;
- Hazardous substance dispersion pathways; and
- Emergency response capabilities.

All contractors will receive applicable training, as outlined in 29CFR 1910.120(e) and as stated in the SHSP. Copies of Training Certificates for all site personnel will be attached to the SHSP. Personnel will initially review the JSA forms at a pre-entry briefing. Site-specific training will be covered at the briefing, with an initial site tour and review of site conditions and hazards. Records of pre-entry briefings will be attached to the SHSP.

Elements to be covered in site-specific training include: persons responsible for site-safety, site-specific safety and health hazards, use of PPE, work practices, engineering controls, major tasks, decontamination procedures and emergency response. Other required training, depending on the particular activity or level or involvement, may include MSHA 40-hour training and annual 8-hour refresher courses. Other training may include, but is not limited to, competent person training for excavations and confined space. Copies of the 40-hour and annual refresher certificates, for site personnel, will be attached to the SHSP.

The individual JSA for the Wabuska Drain work incorporates individual tasks, the potential hazards or concerns associated with each task, and the proper clothing, equipment, and work approach for each task. The following table outlines the tasks and associated potential hazards that are included in the Wabuska Drain JSA:

SEQUENCE OF BASIC JOB STEPS	POTENTIAL HAZARDS
1. Prepare sample bottles and dress in appropriate PPE.	• Burn or corrosion from acid spillage, if sample bottles do not have acid already in them.
2. Collect water sample and decontamination of equipment.	• Skin irritation from dermal or eye contact • Slipping or falling into Drain.
3. All Activities	• Slips, Trips, and Falls
4. All Activities	• Back, hand, or foot injuries during manual handling of materials.
5. All Activities	• Heat exhaustion or stroke.
6. All Activities	• Hypothermia or frostbite.
7. Unsafe conditions.	• All potential hazards.

A copy of the Wabuska Drain JSA is provided in Appendix D.

SECTION 4.0

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